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CANADA'S FORESTS: NO FUTURE WITHOUT GOOD MANAGEMENT

INTRODUCTION

The forest has always played three essential roles in human life. First is its ecological function: simply by its presence, the forest minimizes erosion, controls runoff, improves water and air quality, mitigates climatic extremes and provides the necessary habitat for many species of terrestrial and aquatic life. Second, the forest serves a social purpose as a place to live, relax and play. Finally, it performs an important economic function for Canada by providing wood for heating and construction, paper, chemicals, forage and fertilizers.

Despite unanimous agreement with these basic truths, our current forest harvesting methods take very little account of the forest's three roles - roles which affect the already complex worldwide problems of conserving our diverse environment. The nature of the forest ecosystem continues to be greatly affected by society's short-term economic imperatives. Deforestation, monoculture and the introduction of new tree species are some of the ways in which mankind has shaped and exploited the forests. New monitoring techniques such as photo interpretation, combined with the growing ecological awareness of national and international bodies (Environment Canada, FAO, UNESCO and the UN), have alerted us to the danger of excessive and disorganized use of natural resources. The United Nations Environmental Program (UNEP), the International Union for Conservation of Nature and Natural Resources (IUCN) and the World Wide Fund for Nature (WWF) in the early 1980s recommended the development of a world conservation strategy whose principal aims would be to maintain essential ecological processes and life-support systems, preserve genetic diversity

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and ensure that species and ecosystems are used in a sustained and enduring manner.(1)

More recently, in its major report, the Brundtland Report, the World Commission on Environment and Development stressed the urgency of managing and developing natural resources, including forests, according to the principle of sustainable development. Sustainable development, which has become the cornerstone of the mandate of the new federal Department of Forestry, implies that the earth's natural resources, whether renewable or nonrenewable, must be developed so as to meet the needs of the present without compromising the needs of future generations.(2) The concept of sustainable development is also at the centre of the new *Strategy for Sustainable Living* published recently by the IUCN, UNEP and WWF. This strategy calls for a series of concrete initiatives to "save the planet."(3)

One of the major worries about the world's forest resources is the frightening speed at which tropical forests and those in arid and semi-arid regions are disappearing. In a recent report released by the World Resources Institute, the United Nations Environmental Program (UNEP) and the United Nations Development Program (UNDP) estimated that rain forests were disappearing at a rate of 20 to 25 million hectares per year, that is 50% faster than previously estimated.(4) Today, approximately 50% of the planet's tropical forests have vanished.(5) In Brazil alone,

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(1) International Union for the Conservation of Nature and Its Resources (IUCN), *World Conservation Strategy - Living Resource Conservation for Sustainable Development,* Gland (Switzerland), 1980.

(2) World Commission on Environment and Development, *Our Common Future,* Oxford University Press, 1987, 400 p.

(3) IUCN/UNEP/WWF, *Caring for the Earth - A Strategy for Sustainable Living,* Gland (Switzerland), 1991, 228 p.

(4) Fred Pearce, "Pour une exploitation marchande et non destructrice de la forêt tropicale," *Problèmes économiques,* No. 2.196:13-16, 24 October 1990.

(5) Norman Myers, "Trees by the Billions: A Blueprint for Cooling," *International Wildlife,* September-October 1991, p. 12-15.

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satellite images showed that in 1987, 8 million hectares of Amazon forest, or an area approximately the size of Austria, had been burned or cut. By the end of 1988, it was estimated that 12% of the Amazon rain forest had already disappeared, most of it having gone up in smoke. And the rate of destruction continues to increase.(6) This situation may be explained primarily by the fact that half of the people in the world use wood as their primary fuel and that many forests have been transformed into pastures needed to service the very lucrative international trade in meat.

The decrease in productive forest area has set off an alarm all over the world. Current needs for wood are enormous and estimates for the future are even larger. The Forestry Department of the FAO (Food and Agriculture Organization of the United Nations) estimates that the global demand for industrial round timber should increase by about 45% (from 1,244 to 1,812 million m^3) for the period from 1985-2000. Specifically, global consumption of lumber should rise by about 37% (from 449 to 613 million m^3), while paper and board consumption should increase by 63% (from 187 to 304 million tonnes) and pulp consumption by 51% (from 140 to 211 million tonnes). The most spectacular increase should be in the area of wood-based panels, for which global consumption should reach 232 million m^3, an increase of 117%.(7) The forecasts released by the Canadian group of Woodbridge, Reed and Associates with respect to the supply of forest products show, however, that the increased demand may not be met. For example, the experts estimate that the supply of industrial round timber could reach 1,894 million m^3, up 25% over 1985 supply levels (1,511 million m^3), but nearly 100 million m^3 below the projected demand for the year 2000 (1,992 million m^3).(8)

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(6) Lester R. Brown *et al.*, *State of the World 1989 - A Worldwatch Institute Report on Progress Toward a Sustainable Society*, New York, W.W. Norton and Company, New York, 1989, p. 4 and 31.

(7) FAO, Forestry Department, *Forest Products: World Outlook Projections, 1989-2000*, FAO Forestry Paper 73, Rome, 1986, 101 p.

(8) Woodbridge, Reed and Associates, *Canada's Forest Industry: The Next Twenty Years: Prospects and Priorities, Volume II: World Demand-Supply*, Prepared for the Government of Canada, Canadian Forestry Service, Ottawa, 1988, 157 p.

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Certainly, the medium-term projections for world demand and supply of forestry products suggest interesting possibilities for the development of international markets for countries such as Canada. However, to be a player in the game, Canada must ensure that its forest resources are soundly managed and developed more intensively. In the past, many agencies and sector officials have pointed to the shortcomings in terms of forest regeneration and have stressed the urgent need to move on from the simple harvesting of trees to intensive forestry management. In short, the "forest revolution" must necessarily be based on scientific silviculture principles.

Canada's forests, like Canada's mining and fishing sectors, are a primary resource on the edge of crisis. Ecological deterioration of the forest environment, difficulties in supplying the mills that transform the raw materials and considerable increases in operating costs all hinder the expansion of our forest industry and weaken our products' competitive position on the world market.

This study considers the current state of Canada's forests and the importance of forest industries in our economy. Special attention is given to modern management and operational methods and to the new avenues of research into how to enhance the value of this inestimable natural resource.

THE IMPORTANCE OF CANADA'S FORESTS

The forest industry sector is one of Canada's major employers. It provides some 348,000 jobs directly, and, in addition, 540,000 other workers have forest-related employment. Thus, Canada's forests generate nearly one in fourteen of all jobs in the country. For almost 350 Canadian communities, the primary source of income is the cutting and processing of wood.(9) The regional distribution of employment and the value of shipments of these products are shown in Table 1. It should be noted that the number of jobs in the forest sector

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(9) Forestry Canada, *The State of Forestry in Canada - 1990*, Report to Parliament, *Ottawa, April 1991, p. 9.*

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Table 1

Regional Distribution of Forest Sector Employment and Total Value of Forest Product Shipments, 1988

Region	Direct Employment (thousands)	Total Value of Shipments ($ billions)
Atlantic	34	4
Quebec	110	13
Ontario	84	12
Prairies	21	3
British Columbia	99	17
Total	348	49

Source: Library of Parliament and Forestry Canada, *The State of Forestry in Canada - 1990*, Report to Parliament, *Ottawa, April 1991, p. 9-15.*

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varies considerably from year to year, depending on the general state of the economy. For example, the 1991 recession resulted in the loss of several thousand jobs, in particular in the lumber and pulp and paper sectors.

With 10% of the world's productive forests and 16% of the world's standing coniferous timber, Canada has one of the planet's most dynamic forest industries and more than 20% of the world market for forest products.(10)

In 1989, the forestry sector's contribution to the Canadian economy totalled $20 billion, whereas the value of shipments totalled in excess of $40 billion. In addition to supplying most domestic needs, forest products are also the country's leading net export. Export sales, showing a net trade surplus of $19.5 billion per year, are higher than the net trade surpluses in the fisheries, agriculture, mining and energy sectors combined.(11)

A. Description of Canada's Forests (12)

Canada is a land of forests, with only Brazil and the U.S.S.R. having greater forested areas. Forests cover 45% of Canada's 9.97 million square kilometres (km^2). Our forested land is three times greater than Europe's and our wood volume 1.9 times greater (see Table 2).

Although Canada's forests represent 10% of the world's forested land, they are far from being totally available for forest industry uses. Only 23% (2.3 million km^2) of Canada's total land area is stocked, productive, non-reserved forestland (see Table 3). Nevertheless, Canada has more productive forests overall than it has other types of land and soil uses. In fact, only 7% of Canada's total land area comprises productive farmland, and 8% is covered in water. It should also be mentioned that about 4% of what is considered productive forestland is set

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(10) Forestry Canada, *Forestry Facts*, Minister of Supply and Services, Ottawa, 1990a, p. 4-6.

(11) Forestry Canada (1991), p. 45-46.

(12) Unless otherwise indicated, data in this section are taken from Forestry Canada (1990a and 1991).

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Table 2

World Forest Statistics

	Forested Areas		Volume of Wood	
	million ha	%	million m^3	%
Canada	453	10.4	23,154	7.5
United States	296	6.8	23,600	7.6
Central and South America	988	22.8	97,000	31.2
Africa	744	17.2	25,000	8.0
Europe	159	3.7	12,000	3.9
U.S.S.R.	929	21.4	85,900	27.7
Asia and Oceania	767	17.7	44,000	14.2
World Total	4,336	-	310,654	-

Source: Library of Parliament and Forestry Canada (1990a), p. 4.

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Table 3

Area of Inventoried, Productive and Non-Reserved Forestland
by Stand Density, According to 1986 Inventory*

	Wooded	Non-Wooded	Undetermined	Total
		(millions of hectares)		
Newfoundland	10.39	0.71	-	11.1
Prince Edward Island	0.26	0.02	-	0.28
Nova Scotia	3.58	0.17	-	3.75
New Brunswick	6.05	0.02	-	6.07
Quebec	51.85	2.54	0.05	54.39
Ontario	32.68	4.08	0.05	36.77
Manitoba	12.62	1.57	-	14.19
Saskatchewan	13.31	1.50	-	14.82
Alberta	20.64	0.82	1.53	21.46
British Columbia	45.05	4.04	-	49.09
Yukon	6.24	1.25	-	7.49
Northwest Territories	13.74	0.01	-	13.74
Total	216.41	16.71	1.63	233.15

* The totals may not add up exactly, due to rounding of some numbers.

Source: Library of Parliament and Forestry Canada, *Selected Forestry Statistics Canada, 1990*, Ottawa, Economics and Statistics Directorate, Information Report E-X-44, 1990b, p. 2.

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aside for national and provincial parks. These protected areas encompass nearly 400 million m^3 of wood which, unless an exception is made, cannot be harvested for commercial purposes. Figure 1 gives an overall view of land classification in Canada and the total area of Canada.

Forested areas or stands are usually classified according to forest type. Three types are recognized in this report: softwood, mixed wood and hardwood. They are identified by the proportion of the forest (in terms of surface area or volume) that is coniferous. The softwood forest in the north, predominately in British Columbia, is the largest of the three types in area (65% of total), volume (77% of total) and average volume (112 m^3/ha). Mixed-wood forests extend through the Maritimes, and through central Quebec, Ontario and the Prairies and rank second in area (23% of total) and volume (18% of total) but third in average volume (82 m^3/ha versus 89 m^3/ha for hardwoods). The hardwoods, mostly birch and maple, occur in a band across southern Quebec and southern Ontario, thinning in southern Manitoba and Saskatchewan but broadening again in Alberta where aspen/poplar predominates.(13) Table 4 shows the distribution by species group and region. As softwoods represent 76% of available wood volume, it is easy to see their importance within our forest industry.

Approximately 59% of the inventoried productive forestlands(14) are almost equally distributed among British Columbia, Ontario and Quebec. The Prairie provinces have 23% and the Atlantic region 9% of such lands. Most of this forestland belongs to the provinces, except in Prince Edward Island and Nova Scotia, where it is largely in private hands. Federal Crown land is mainly in the Yukon and Northwest Territories which, although occupying 39% of Canada's total area, have only 9% of its productive forestland.

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(13) G.M. Bonnor, *Canada's Forest Inventory, 1981*, Environment Canada, Chalk River, 1982, p. 14.

(14) "Productive forestland" includes both land with trees that will eventually reach usable size and volume and treeless land that could be used for productive forestry.

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Figure 1

Forestlands of Canada

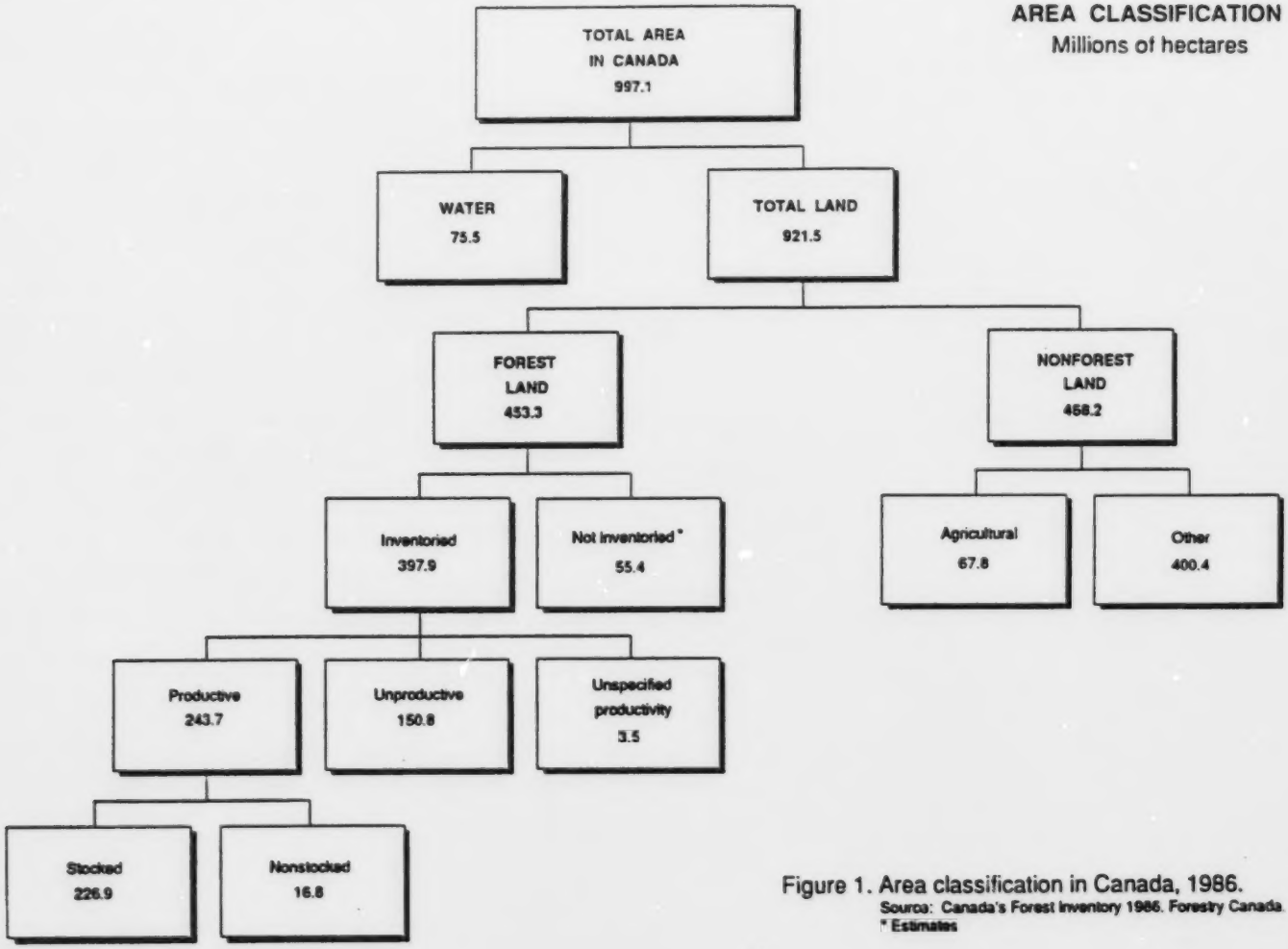

Figure 1. Area classification in Canada, 1986.
Source: Canada's Forest Inventory 1986. Forestry Canada.
* Estimates

Source: Forestry Canada, *Selected Forestry Statistics Canada, 1990*, Economics and Statistics Directorate, Information Report E-X-44, Ottawa, 1990b, p. 3.

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Table 4

Wood Volume (as % of Total) by Species Group and Region, According to the 1986 Inventory

	Region						
Species Group	Atlantic	Quebec	Ontario	Prairies	B.C.	Territories	Canada
Spruce	1.6	7.7	5.8	6.0	8.5	1.4	30.9
Pine	-	1.1	2.5	4.2	9.3	-	17.6
Fir	1.2	3.8	0.8	-	6.0	0	12.2
Hemlock	-	-	-	0	5.3	0	5.5
Cedar	-	-	-	-	3.0	0	3.8
Douglas Fir	0	0	0	-	3.0	0	3.0
Unspecified Coniferous	1.1	-	-	-	0	1.5	3.9
Total Coniferous	4.4	13	9.5	11.5	35.3	3.2	77
Aspen/Poplar	-	1.3	3.0	5.7	2.6	-	12.9
Birch	-	2.3	1.6	-	-	-	4.9
Maple	0.6	1.3	0.9	-	-	0	2.8
Unspecified Deciduous	-	-	-	0.8	-	0.6	2.4
Total Deciduous	1.5	5.2	5.7	6.8	3.0	0.8	23.0
TOTAL	5.9	18.2	15.2	18.3	38.3	4.0	100

-: less than 0.5%

Note: Canada's forest population includes 31 species of conifers and approximately 100 species of deciduous trees.

Source: Library of Parliament and Forestry Canada, *Selected Forestry Statistics Canada, 1990*, Ottawa, Economics and Statistics Directorate, Information Report E-X-44, 1990b, p. 4-5.

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B. Evolution of Forested Areas

Canada's forest, nearly 77% coniferous, contains 16% of the world's volume of standing softwoods. This is the result of a long evolution, taking place over many generations and resulting in the triumph of conifers throughout most of the area (see Figure 2).

The birth and growth of a forest anywhere on this planet is the result of a complex joining of elements with reciprocal influences that are still rather mysterious. Soil, climate and the lay of the land shape Nature's crucible, determining the future pattern of forest. For example, if fire destroys a forest of black spruce in Canada's north, in a few years a pioneer forest of paper birch, grey birch and poplars will appear. After 40 or 50 years, black spruce and balsam fir will emerge, which, after 50 more years, will dominate the landscape. After three or four centuries of decline in fir, black spruce will once again reign alone, a witness to ecological constancy.(15)

Many factors affect the evolution of a forest. They include natural disasters (fire, storm, flood, insects and disease) as well as animals and man. Man has become the most disturbing element in many forests over the last few centuries, as can be seen from the disappearance of the legendary white and red pine forest of eastern North America, which extended across 3,000 km from Cape Breton to Lake Winnipeg. The early settlers regarded this forest as an obstacle rather than an asset. They burned far more timber than they used in the process of clearing land for agriculture.(16) Commercial use of the timber was slow to develop. It was not until 1808, after Napoleon's blockade of the Baltic Sea and thus Britain's wood supplies, that commercial exploitation of Canada's forest began on a large scale. The growth of the timber trade was explosive. Logging legends were born and the forests came to be seen as the source of fortunes. By 1850, the magnificent forests of white pine had disappeared from the accessible lands throughout the Maritimes, up the St. Lawrence and

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(15) Canadian Pulp and Paper Association, *The Forest Book*, Montreal, 1972, p. 7.

(16) F.L.C. Reed, "Importance of the Forest Industry in the Canadian Economy," *The Forest Imperative*, Proceedings of the Canadian Forest Congress, Toronto, 1980, p. 17.

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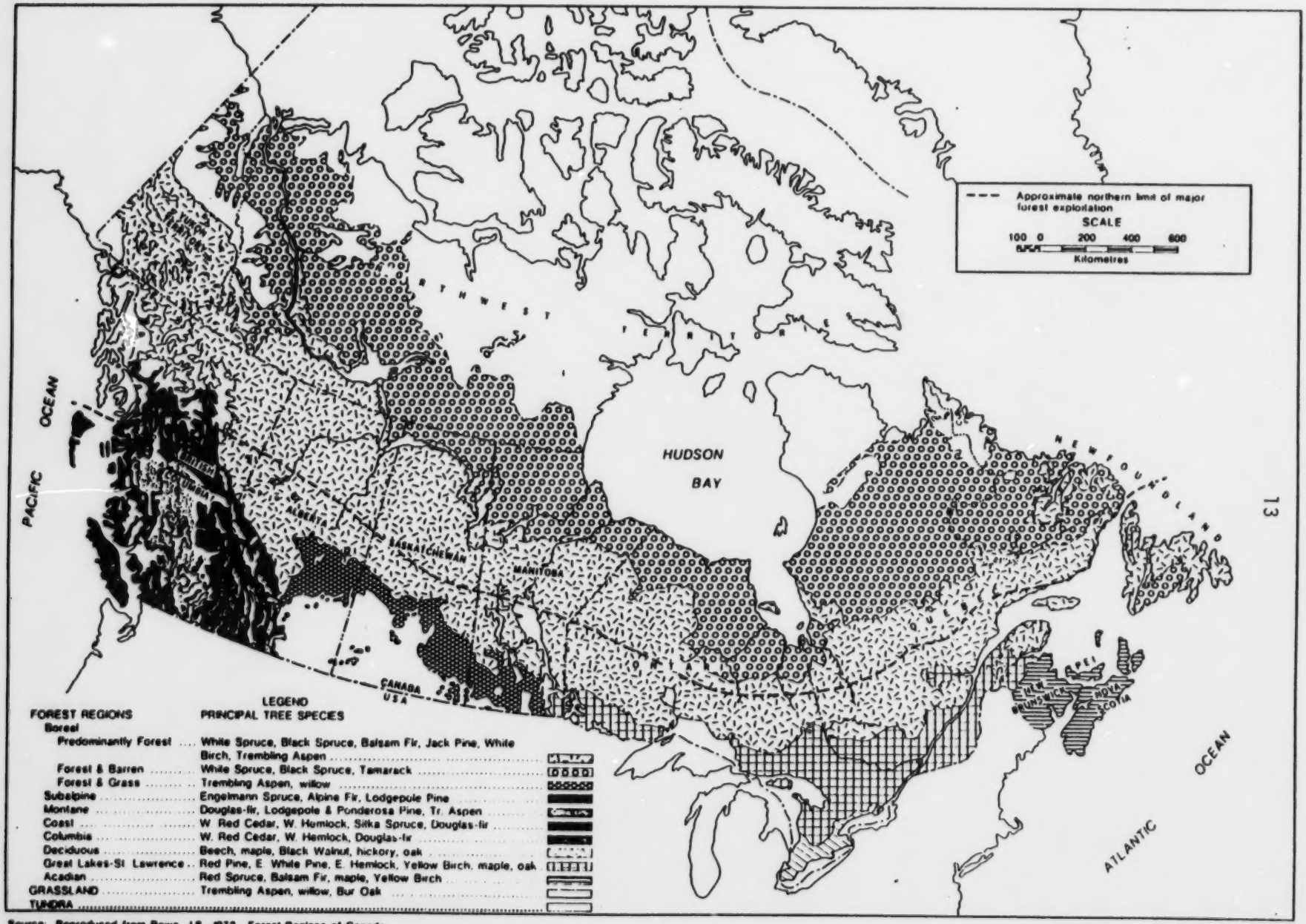
FIGURE 2: Forest regions of Canada


Approximate northern limit of major forest exploitation
SCALE
100 0 200 400 600
Kilometres
PACIFIC OCEAN
HUDSON BAY
ATLANTIC OCEAN
YUKON TERRITORY
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
NEW BRUNSWICK
P.E.I.
NOVA SCOTIA
CANADA
USA
LEGEND
FOREST REGIONS
PRINCIPAL TREE SPECIES
Boreal
Predominantly Forest .... White Spruce, Black Spruce, Balsam Fir, Jack Pine, White Birch, Trembling Aspen
Forest & Barren .... White Spruce, Black Spruce, Tamarack
Forest & Grass .... Trembling Aspen, willow
Subalpine .... Engelmann Spruce, Alpine Fir, Lodgepole Pine
Montane .... Douglas-fir, Lodgepole & Ponderosa Pine, Tr. Aspen
Coast .... W. Red Cedar, W. Hemlock, Sitka Spruce, Douglas-fir
Columbia .... W. Red Cedar, W. Hemlock, Douglas-fir
Deciduous .... Beech, maple, Black Walnut, hickory, oak
Great Lakes-St. Lawrence .. Red Pine, E. White Pine, E. Hemlock, Yellow Birch, maple, oak
Acadian .... Red Spruce, Balsam Fir, maple, Yellow Birch
GRASSLAND .... Trembling Aspen, willow, Bur Oak
TUNDRA ....

Source: Reproduced from Rowe, J.S., 1972. Forest Regions of Canada with modifications by G.F. Weetman.

Source: Environment Canada, Stress on Land in Canada, Lands Directorate, Wendy Simpson-Lewis et al., Co-ordinator, Ottawa 1983, p. 268.

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throughout the Ottawa River watershed. The Douglas fir forests of British Columbia were being logged commercially in the 1870s, without any kind of management. What had taken thousands of years to build was in danger of permanent mutilation.

In response to concern about the disappearance of some of Canada's forests, the Canadian Forestry Association was formed in Montreal in 1900. At the same time, provincial governments began to grant long-term development permits and leases to pulp and paper companies for extensive areas of Crown timberland. Provincial governments were so eager for pulp and paper mill development that they granted tenure to the timberland with little or no demand for forest management.(17) In time, the overabundant forest was attacked by the onslaught of settlers and industry alike. Local shortages of timber became common, forcing industry to turn to smaller trees and to less attractive species such as black spruce, jack pine and balsam fir. Wide-scale exploitation of the coastal forest in Atlantic regions came early in the 1900s, though in the central and northern interior regions it was not until the late 1940s.(18) Forest management began only in the 1950s, in a limited and sporadic way. The first forest inventories were completed in 1955-56, when forest fire control and spruce budworm control programs were being established. But all this happened 150 years after some of the country's most beautiful forests had been over-exploited.

In 1850, the average tree felled in Canada east of the Rockies contained 400 to 500 board feet of lumber. The average tree now harvested in that part of the country contains barely 70 board feet. Without dramatic technological improvement, the Canadian forest industry would not have been able to survive the increased costs associated with having to cut, haul and process six times as many trees to produce the same

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(17) Canadian Institute of Forestry, *A Case for Improved Forest Management in Canada*, Brief to the Royal Commission on the Economic Union and Development Prospects for Canada (the Macdonald Commission), Ottawa, December 1983, p. 4-5.

(18) Reed (1980), p. 17-18.

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product volume.(19) When we consider these and similar facts,(20) we may be tempted to think harshly of the forest industry. F.L.C. Reed, former Assistant Deputy Minister, Canadian Forestry Service, points out that the early liquidation of the forest's wealth provided three essential elements for the economic well-being of preceding generations:

> First, the forests made available the capital necessary to build farms, cities, industry and social infrastructure of all kinds. Second, clearing of land for agriculture and food production was equally necessary for a rapidly expanding population. Third, revenue from Crown forests became a cornerstone of provincial finance. In fact, the timber industry provided the scaffolding of industrialization. To deny these points would be to misinterpret history and turn the clock back two hundred years.(21)

Nevertheless, resources cannot be exploited in an anarchistic and mercenary way without endangering the health and equilibrium of the environment and the prosperity of generations to come who will depend on it. Recent reports and studies denounce the poor management and sorry state of our woodlands. In 1978, a firm of consulting economists reported that there were wood shortages across the country, that forests were frequently harvested with no thought for reforestation and that government and industry had, in general, been derelict in their duties. According to the report's authors, "most of the forest is not managed in a way that would enable it to respond to current production levels indefinitely, let alone expansion of the forest industry."(22) In 1983, the Science Council of Canada painted a bleak picture of the state of Canada's forests in these terms:

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(19) Canadian Institute of Forestry (1983), p. 5-6.

(20) For more background on this subject, see Jamie Swift, *Cut and Run: The Assault on Canada's Forests*, Between the Lines, Toronto, 1983, 283 p.

(21) Reed (1980), p. 18.

(22) R.M. Newnham, *Forest Management in Canada: Summary*, F.L.C. Reed and Associates Ltd., Forest Management Institute, Information Report FMR-X-102, February 1978, p. 47.

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> The forests provide a renewable resource. Until the last decade, however, Canadians have often regarded forests as something to be exploited and have depended too heavily on natural regeneration rather than scientific management for optimal regeneration. We are now suffering the results of this attitude. Much of Canada's high-quality, old-growth forest has been harvested; much that remains accessible is overmature and defective. Fire, insects, disease and wind destroy two-thirds as much timber as is harvested annually. Local shortages of commercially suitable wood have developed in every province in recent years, and conflicts of interest over land use are increasing. One-eighth of Canada's productive forest area has deteriorated to the point where huge tracts lie devastated, unable to regenerate to a merchantable crop within the next 60 to 80 years. Each year, some 200,000 to 400,000 ha of valuable forest are being added to this shameful waste.(23)

THE CANADIAN FOREST INDUSTRY

Canada's 1988 harvest of some 180 million m^3 of wood of all kinds represented only 5.3% of the wood cut all over the world. Another surprising fact is that about 52% of the global wood cut is used for heating. For example, China and India use more than 400 million m^3 of heating wood or 24% of the world total. Although a serious shortage of this product now affects nearly 100 million people throughout the world, this is not of general concern to Canadians. Our annual harvest of heating wood is only 0.4% of the world's total (see Table 5).

At present, Canada supplies more than 20% of world demand for forest products (see Figure 3). Sixty-five per cent of our shipments go to the United States, 15% to the European Economic Community (or Common Market), 11% to Japan, and the remaining 9% to 45 other nations. Of the $23 billion in forest products exported by Canada in 1989, 30% was accounted for by the pulp sector and newsprint sector respectively, while the softwood sector accounted for nearly 25% of exports. Each of Canada's regions has a specialty: British Columbia accounts for about 60% of

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(23) Science Council of Canada, *Canada's Threatened Forests*, Ottawa, 1983, p. 5.

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Table 5

World Production of Roundwood in 1988

Country and Region	Industrial Roundwood		Fuelwood and Charcoal		Total Roundwood	
	M m^3	%	M m^3	%	M m^3	%
Canada	173.1	10.4	6.8	0.4	180.0	5.2
United States	416.7	25.0	116.3	6.6	532.9	15.5
Scandinavia	103.9	6.2	8.5	0.5	112.4	3.3
U.S.S.R.	305.0	18.3	86.8	4.9	391.8	11.4
Europe (less Scandinavia and U.S.S.R.)	308.5	18.5	56.1	3.2	364.6	10.6
Brazil	66.6	4.0	179.1	10.1	245.7	7.2
Other Countries of Latin America	40.5	2.4	98.9	5.6	139.4	4.1
Latin America	107.1	6.4	278.0	15.7	385.1	11.2
China	98.5	5.9	177.6	10.0	276.1	8.0
India	24.2	1.5	240.2	13.6	264.4	7.7
Japan	27.8	1.7	0.6	0.03	28.4	0.8
Other Asian Countries	115.4	6.9	364.1	20.6	479.5	14.0
Asia	265.9	16.0	782.5	44.3	1,048.4	30.6
Africa	56.0	3.4	432.0	24.4	488.0	14.2
Oceania	31.3	1.9	8.8	0.5	40.1	1.2
World - Total	1,663.7	100.0	1,767.4	100.0	3,431.1	100.0

Source: Library of Parliament and Forestry Canada, *Selected Forestry Statistics Canada, 1990,* Ottawa, Economics and Statistics Directorate, Information Report E-X-44, 1990b, p. 195.

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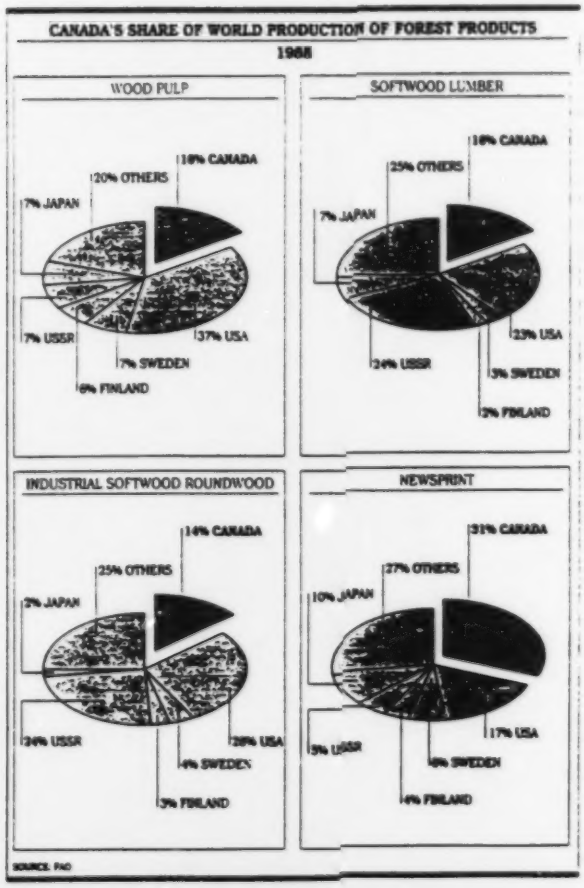
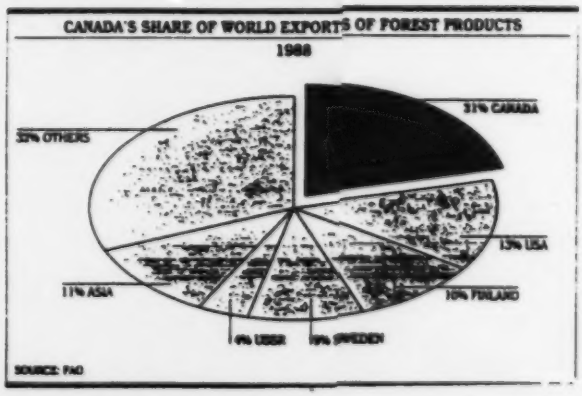
Figure 3

Canada's Share of World Markets for Forest Products





Source: Forestry Canada, *The State of Forestry in Canada*, 1990 Report to Parliament, Ottawa, April 1991, p. 48 and 51.

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Canadian lumber; central Canada is heavily oriented to pulp and paper; and Ontario and Quebec account for almost two-thirds of total value-added in Canadian paper and allied industries.(24)

Primary forest products are usually classified in one of two categories, either pulp, paper and paperboards, or lumber, plywood and other wood products. The lumber, pulp and newsprint sectors, which account for about 60% of total industry production, constitute 80% of all forest product exports. Some sub-sectors, such as plywood, waferboard and certain grades of paper, sell in both domestic and export markets. Other product sectors, particularly high-value-added products such as millwork, kitchen cabinets and converted paper products, have also developed considerably to serve the Canadian market.(25)

However, the most revealing fact about Canadian trade in forest products is its vulnerability. This is seen in the small number of markets and in the concentrated production of a limited number of products. In addition, as wood becomes increasingly scarce, with the result that costs and prices of lower-value products may move closer together, it might be possible to improve our export position by turning to higher-value-added products.(26) Thus, it seems that the secret of reducing our vulnerability to economic fluctuations lies in diversifying our products and markets and making full use of new technology.(27)

A. Pulp and Paper Industry

World production of all kinds of pulp, paper and board (newsprint, printing papers, paper and board for packaging, etc.) has

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(24) Forestry Canada, *Forestry Facts*, Ottawa, Minister of Supply and Services, 1990a, p. 12.

(25) Forestry Canada, Economics and Statistics Directorate, *Selected Forestry Statistics, Canada, 1990*, Information Report E-X-44E, Ottawa, 1990b, p. 119.

(26) Environment Canada, Canadian Forestry Service, *Submission to the Royal Commission on the Economic Union and Development Prospects for Canada*, January 1984, p. 5.

(27) Ginette Beaulieu, "Pour sortir la forêt de la crise," *Forêt Conservation*, Vol. 49, No. 10, March 1983, p. 13.

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almost tripled since the early 1960s (see Table 6). Table 7 shows the 12 countries that produced over 2 million tonnes of paper and board in 1988. The United States is by far the largest producer with 69.6 million tonnes, or nearly one-third of total world production. Japan ranks second with 24.6 million tonnes, followed by Canada with 16.6 million tonnes, and China with 14.1. More than 50% of the wood pulp produced in the world comes from Canada and the United States. Other major producers include Japan, the U.S.S.R., Sweden and Finland.

The world's pulp and paper industry relies on four major exporters: Canada ($12 billion), Sweden ($6.1 billion), Finland ($6.6 billion) and the United States ($5.8 billion).(28) Exports by these four countries accounted for nearly 60% of the world's export total in 1988. In addition, the United States and the European Economic Community together account for nearly two-thirds of the world's pulp and paper imports.(29) The U.S. buys mainly from Canada while the EEC buys primarily from the Scandinavian countries.

In 1988, pulp and paper exports represented approximately 9.5% ($12.7 billion) of the value of all Canadian exports ($75.4 billion). In the same period, 65% ($8.2 billion) of Canada's exports in this sector went to the U.S. market,(30) representing 8.3% of all Canada's exports to the United States. The U.S. is Canada's largest customer for pulp and paper, but its own forest industry is becoming increasingly competitive. For example, 40 years ago, the United States imported 82% of its newsprint requirements; in 1985, this figure had declined to 60% and it is expected that this figure will level off until the year 2010.(31) From 1952 to 1982, American newsprint purchases from American mills grew by 420%, while their imports from Canada rose by only 26%. In 1952, American domestic

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(28) Forestry Canada (1990b), p. 205.

(29) Forestry Canada (1990b), p. 207.

(30) Forestry Canada (1990a), p. 22, 43 and 45.

(31) Woodbridge, Reed and Associates, *Canada's Forestry Industry - The Next Twenty Years: Prospects and Priorities, Volume III: Pulp and Paper*, Prepared for Government of Canada, Canadian Forestry Service, Ottawa, December 1988, p. 161-162.

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Table 6

World Production of Wood Pulp, Paper and Board
(thousands of metric tonnes)

	Pulp				Paper and Board			
	1960	1970	1980	1988	1960	1970	1980	1988
North America	32,964	54,912	65,969	79,080	38,917	58,914	70,225	86,225
Europe (including U.S.S.R.)	20,965	34,853	40,235	47,099	25,634	45,159	59,023	74,547
Asia/Oceania	5,156	14,268	18,239	16,543	7,861	20,621	31,962	49,805
Latin America	821	2,224	5,848	6,756	1,656	3,712	7,737	11,287
Africa	124	900	1,502	1,704	288	892	1,717	2,466
Total	60,031	107,157	131,793	151,182	74,355	129,298	170,664	224,330

Source: Library of Parliament; Peter Sutton, Dave O'Donoghue and John Kalish, "Worldwide Pulp and Paper Industry: Decline in 1982 but Hope in 1983," *Pulp and Paper*, Vol. 57, No. 8, August 1983, p. 54; and Forestry Canada (1990b), p. 201 and 203 for data on 1988.

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Table 7

The World's Top 12 Pulp and Paper Producers, 1988

	Paper and Board Production (thousands of metric tonnes)			Wood Pulp Production (thousands of metric tonnes)	
1.	United States	69,587	1.	United States	55,530
2.	Japan	24,625	2.	Canada	23,550
3.	Canada	16,638	3.	Japan	10,407
4.	China, People's Rep.	14,144	4.	U.S.S.R.	10,374
5.	Germany, Fed. Rep.	10,576	5.	Sweden	10,074
6.	U.S.S.R.	10,216	6.	Finland	9,001
7.	Finland	8,652	7.	Brazil	4,375
8.	Sweden	8,161	8.	Germany, Fed. Rep.	2,358
9.	France	6,313	9.	France	2,201
10.	Italy	5,513	10.	Norway	1,974
11.	Brazil	4,639	11.	China, People's Rep.	1,778
12.	United Kingdom	4,296	12.	Spain	1,604

Source: Library of Parliament and Forestry Canada, Economics and Statistics Directorate, *Selected Forestry Statistics Canada, 1990*, Information Report E-X-44, Ottawa, 1990b, p. 201 and 203.

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purchases were only one million tonnes, meeting 18% of that country's needs, while 30 years later, they had reached 4.2 million tonnes, representing 43% of domestic requirements. In addition to supplying 70% of the increase in their needs domestically over the past 30 years, the Americans have recently used investments to improve the production capacity of American mills from 3.8 to 5.4 million tonnes in 1988. This was a very rapid increase which, combined with the size of forest reserves and the rapid growth of species in the southern U.S., makes the Americans much less dependent on our products.(32) Generally speaking, the American pulp and paper industry has the lowest costs in the world. The differences in costs of production between Canadian and American firms are explained by the following three factors:

> Firstly, American papermakers are not unionized. Canadian mills are. Secondly, Canada's old mills must compete with America's modern ones. Thirdly, the most significant cost difference between the two countries is probably that of raw materials. Although much progress has been made in mechanizing the extraction process, the ever-increasing distance between the source of supply and Canada's mills makes transportation costs prohibitively high. Trees grow in Canada only half as fast as those in the southern U.S., which means that Canadian businesses must go farther to get their supplies.
>
> Historically, the price of newsprint was set by Canada's largest firms. However, Canada's share of the U.S. market has been dropping since World War II, and so, two years ago (1981), for the first time, it was the American firms that imposed a decrease in the price of newsprint. Canadian firms appear to have lost their initiative in the vital area of price-setting.(33)

The pulp and paper industry accounted for about 52% of the value of all forest products introduced in Canada in 1988, with annual

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(32) Association des industries forestières du Québec, "Dans le domaine du papier journal: les États-Unis comptent de moins en moins sur l'importation," *Forêt Conservation,* Vol. 50, No. 3, June 1983, p. 20-21; and Forestry Canada (1990b), p. 203.

(33) Environment Canada, Canadian Forestry Service, Economics Division, *Perspectives à moyen terme de l'industrie forestière,* Hull, 28 October 1983, p. 5-6.

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sales of $23 billion. Canada's pulp and paper industry has always enjoyed the technical advantage of being supplied from forests of softwood that produce the long fibres needed for production of high-quality newsprint and pulp. Nevertheless, recent technical progress has accentuated the competition with our southern neighbours. The high productivity of pine forests in the southern United States and the growing use of short fibres from hardwood pulp on international markets does not improve our competitive position vis-à-vis the United States.(34)

While the United States is relying more and more on domestic production, this is not true of the 10 members of the European Economic Community. Twenty years ago, these countries produced enough to meet 60% of their own needs, but in 1982, they only supplied one-third. The Scandinavian countries because of their proximity to the EEC are in the best position to meet this increasing demand. Aside from the two largest markets, the U.S. and the EEC, only four countries imported more than 100,000 tonnes at the beginning of the 1980s: Australia (191,000 tonnes), Brazil (180,000 tonnes), India (175,000 tonnes) and Venezuela (143,000 tonnes).(35) Nevertheless:

> What is happening in these countries is typical of what is expected in other places. During the last three years in three of these countries (Venezuela does not produce newsprint), production capacity has increased from 480,000 to 700,000 tonnes, that is, by nearly 50%. Two expansion projects are planned for Brazil in 1985 that will increase production capacity by 200,000 tonnes. Thus, suppliers cannot take these markets for granted.(36)

Exporting countries such as Canada, therefore, must fight fiercely to protect their interests. The battle will be won by the competitor providing the best products at the best price.

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(34) Canadian Pulp and Paper Association, *Submission to the Royal Commission on the Economic Union and Development Prospects for Canada*, Thunder Bay, October 1983, p. 5-10.

(35) Association des industries forestières du Québec, "Le papier journal dans le monde: un marché de plus en plus difficile?", *Forêt Conservation*, Vol. 50, No. 5, September 1983, p. 22-23.

(36) *Ibid.*, p. 23.

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B. Lumber, Plywood and Other Wood Products

At present, approximately 16% of the world production of softwood lumber comes from Canada and this should remain steady for the rest of this decade. Exporting some 70% of its output, Canada accounts for about 40% of all international trade in this product. Canadian lumber production in 1989 reached 59 million m^3, compared to 45 million m^3 in 1980.(37)

Most of the sawmills across the country are small businesses employing fewer than 100 people. British Columbia supplies 61% of Canada's lumber, followed by Quebec (18%), Ontario (10%), Alberta (7%) and New Brunswick (2%). Nearly three-quarters of the lumber produced in British Columbia crosses Canada's borders, while nearly half of the production of the other provinces is exported.(38)

Some 90% of Canadian plywood is made from softwood species, in British Columbia, it is 80%. Plywood is primarily a structural material suitable for construction, industrial, agricultural and utility purposes. The plywood industry operated 78 mills in 1987, of which 22 were in British Columbia. These mills account for 80% of Canadian plywood production. The rest is produced mainly by mills in Alberta, in Saskatchewan and in Ontario. Waferboard, unlike Canadian plywood which goes primarily to the domestic market, represents a substantial export commodity (97% goes to the United States).(39) Nevertheless, Canadian mills face increasing competition from new mills that recently entered production there.

In view of the diversity in the Canadian production of primary and secondary forestry products, it would be quite difficult to draw a picture of the overall forestry industry in Canada. However, Figure 4 illustrates the range of forestry products in Canada. Despite its diversity, some industry officials have expressed pessimism about the wood industry:

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(37) Forestry Canada (1990a), p. 5-6 and 34; and (1990b), p. 40-41.

(38) Forestry Canada (1990b), p. 46.

(39) Forestry Canada (1990a).

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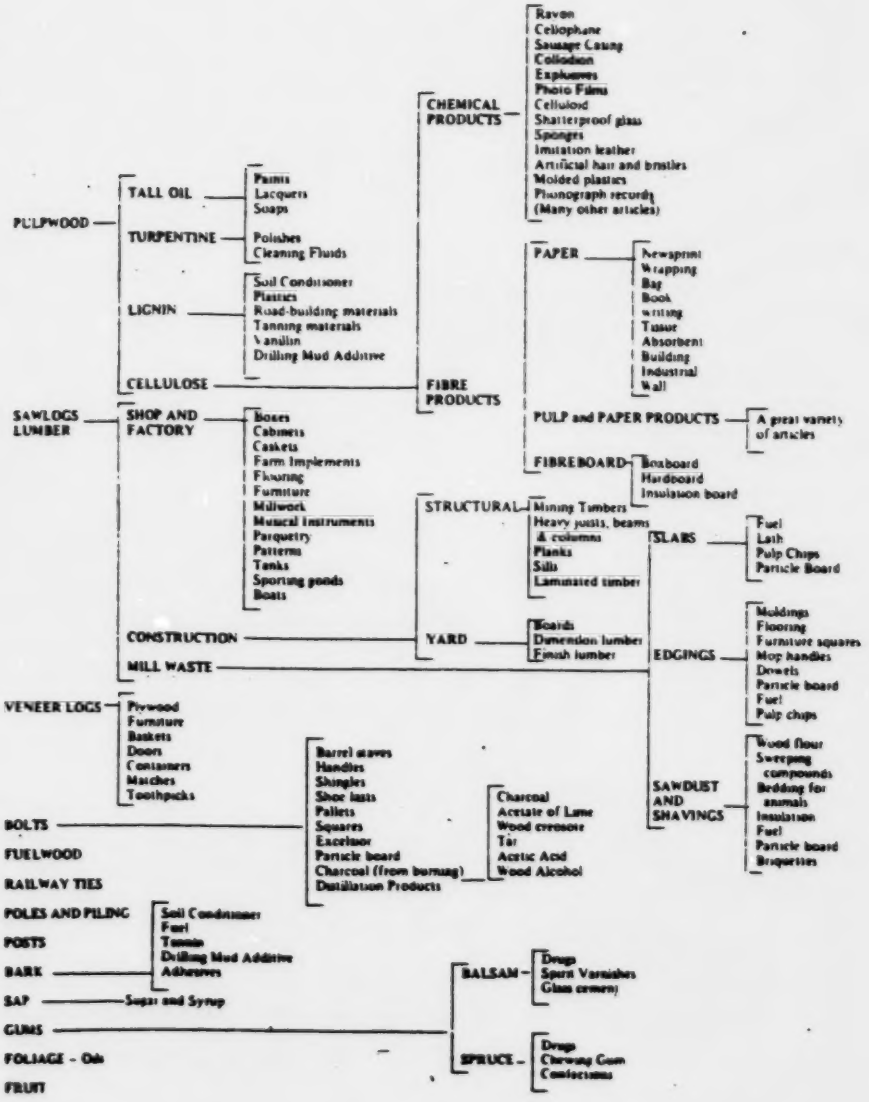
FIGURE 4: PRODUCTS FROM CANADA'S FORESTS



Source: Ontario Forestry Association, "These products come from Canada's trees", The Forest Scene, Vol. 15, No. 1, March 1984, p. 6.

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> Never in its long history has the Canadian lumber industry been so threatened by factors outside its control. Three of these are obvious: the growing international trend toward trade protectionism, fluctuations in exchange rates, and high interest rates that have put such a severe strain on the housing market. All of these present serious medium- and long-term problems for the industry.(40)

Aside from economic factors, the state of the forest resource affects the vitality of the wood industry:

> In addition to the 12% of our productive forestland now in dismal condition, each year pests, fire and development destroy enough trees to make a strip a mile wide between Montreal and Miami. Such an area - and the loss grows every year - if properly reforested, would supply the forest industry with full harvests for 30 years.(41)

CURRENT STATE OF CANADA'S FOREST RESOURCES

It has been recognized for some time that availability of wood is the key to future growth of processing facilities and that wood in economically harvestable locations is increasingly scarce.(42) Local shortages of wood at a competitive cost have emerged in certain regions of the country. Supplies of larger, higher-quality hardwood logs have been almost depleted.(43) Economically harvestable forests are receding farther and farther from existing mills. It is often not competitive to go farther than 160 km from a mill to cut wood. Many mills have reached this

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(40) André Lemire, Address to the Canadian Lumbermen's Association annual meeting, February 1984, also available as "Congrès de l'ACIB: un discours pas très rose," *Forêt Conservation*, Vol. 51, No. 1, April 1984, p. 35.

(41) *Ibid.*

(42) Howard Hart, "Commitment by the Industry to Implementing Improved Forest Management," *The Forest Imperative*, Proceedings of the Canadian Forest Congress, Toronto, September 1980, p. 91.

(43) Environment Canada, *Policy Statement: A Framework for Forest Renewal*, Ottawa, 2 September 1982, p. 2.

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critical limit.(44) A shortage of wood does not necessarily mean that we are running out of wood, but for the industry it means that wood at an economically useful price is in short supply. Because not enough attention was paid to forestry management in the past, the needed trees were sought farther and farther north. However, the farther north one goes, the slower the tree growth, the smaller the size of trees and the longer the distance between forest and mill. Quebec, for example, had a timber deficit in five of its nine administrative regions as early as 1977.(45) Already by the mid-1980s, the forest industries association of Quebec reported that the harvest in seven of the nine regions exceeded the net annual growth; in addition, the only significant reserves on the North Shore were of small trunk size and would be very costly to harvest.(46)

The total volume of wood that can be harvested annually during a given period of time is referred to as the "allowable annual cut" (AAC). Application of this concept regulates the harvest at the level at which the forest can produce and sustain an assured supply of timber.(47) The AAC is determined on the basis of tree growth, losses due to pests and other natural causes, and the market value of trees, and also on the basis of social and economic factors. The level therefore fluctuates over time, depending on the general state of forest stocks, forestry management efforts, public concerns over forest uses and economic conditions. It should be mentioned that the AAC for each forest management unit is determined by provincial forestry services. Setting the AAC for all of Canada remains, therefore, an exercise in integrating provincial

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(44) Claude Turcotte, "L'industrie forestière est à un tournant majeur," *Le Devoir*, 15 June 1984, p. 17.

(45) Jean-Paul Nadeau and Rosaire Couturier, "Forest Regeneration in Canada: A Must for Managers, Industry, State and People," *Tomorrow's Forest ... Today's Challenge?*, Proceedings of the National Forest Regeneration Conference, Canadian Forestry Association, Quebec City, October 1977, p. 14.

(46) Association des industries forestières du Québec, "Une forêt pour toujours," *Le Devoir*, 15 June 1984.

(47) Forestry Canada (1991), p. 21-22.

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evaluations, even though the provinces may use different approaches and criteria.

Figure 5 shows that the AAC, particularly that for softwood, increased slightly from 1957 to 1976, when it peaked. At the beginning of the 1980s, it declined and levelled off so that since 1986, the harvest of softwood has remained steady at the AAC level. A recent study conducted by Forestry Canada showed that the AAC is currently estimated at 233 million m^3, that is, 175 million m^3 of softwoods and 58 million m^3 of hardwoods (Tables 8 and 9). The average harvest from 1986 to 1989 was estimated at 170 million m^3 of softwoods and 16 million m^3 of hardwoods, of which 22 million m^3, mostly of softwoods, were harvested on private forestlands.(48) While we can conclude that over the medium term (20 to 30 years) Canada's wood supply will be assured through established stands, it is also estimated that at the current rate, the softwood harvest is approaching maximum sustained yield capacity. Already, some provinces are experiencing shortages of softwoods, in particular Newfoundland, which is considering supplying some pulp and paper mills with timber harvested in Labrador, and New Brunswick, which already imports wood from Quebec and the United States for similar purposes.

Over the longer term, evaluating Canada's wood supply remains a very difficult proposition; several factors come into play, such as forest regeneration efforts and technological advances that will allow for more efficient use of wood or facilitate access to now inaccessible forests, as well as a sustained increase in the demand for timber.(49) Nevertheless, the more optimistic observers, such as Mr. Les Reed of the Faculty of Forestry of the University of British Columbia, believe that more intensive forestry practices, coupled with improved methods of controlling fires, pests and disease, should make it possible to double the

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(48) K.L. Runyon, *Canada's Timber Supply: Current Status and Outlook*, Information Report E-X-45, Forestry Canada, Ottawa, 1991, 138 p., p. 5.

(49) Runyon (1991), p. 30; Forestry Canada (1991), p. 23.

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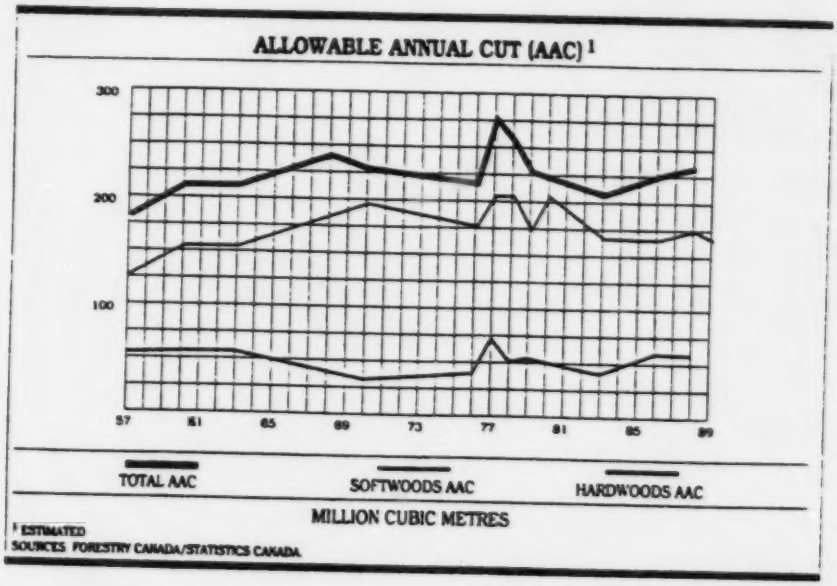
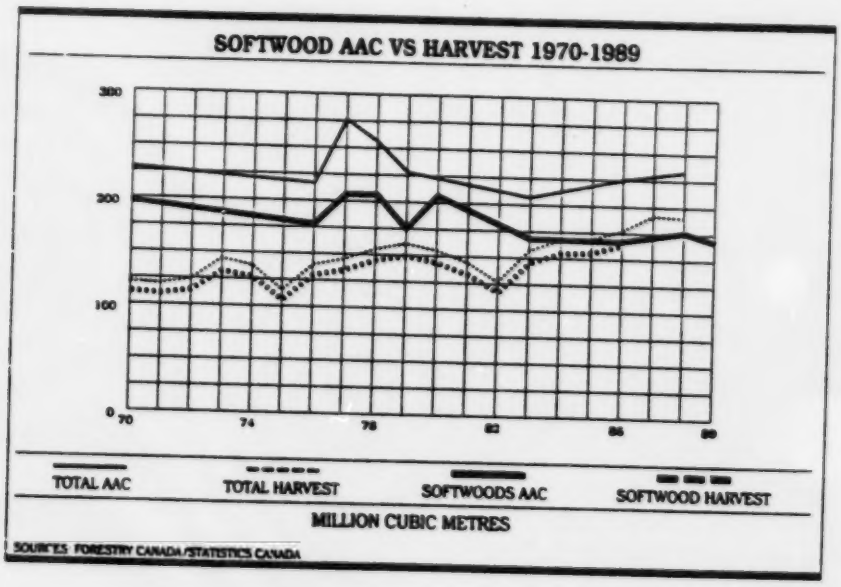
Figure 5





Source: Forestry Canada, *The State of Forestry in Canada, 1990 Report to Parliament*, Ottawa, April 1991, p. 22-23.

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Table 8

Estimated Current AAC in Canada
by Province and Species Group

Province	Allowable Annual Cut (AAC)		
	Softwoods	Hardwoods	Total
	1 000 000 m^3		
British Columbia	74.7	–[a]	74.7
Alberta	15.1	11.6	26.7
Saskatchewan[b]	3.6	3.0	6.6
Manitoba	2.6	2.3	4.9
Ontario[b]	28.4	16.9	45.3
Quebec	35.7	19.0	54.7
New Brunswick	8.1	3.6	11.7
Nova Scotia	3.5	1.8	5.3
Prince Edward Island	0.3	0.2	0.6
Newfoundland[c]	3.0	–	3.0
Canada	175.0	58.4	233.4[d]

Totals may not add exactly due to rounding.

[a] A separate AAC for hardwoods is not calculated.
[b] AAC is maximum allowable depletion from all sources.
[c] Figure includes Labrador. A separate AAC for hardwoods is not calculated.
[d] Some private lands are not included in this number. The harvest on these lands in 1986 was about 22 million m^3.

Sources: Forestry Canada and provincial government estimates.

Source: K.L. Runyon, *Canada's Timber Supply: Current Status and Outlook*, Information Report E-X-45, Forestry Canada, Ottawa, 1991, p. 23.

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Table 9

Comparison of Softwood AAC and Harvests

Province		AAC	Average Harvest (1982–86)	1986 Harvest
			1 000 000 m^3	
B.C.[a]	Crown	74.7	62.2	68.0
	Private	–	9.1	9.5
	Total	74.7	71.3	77.5
Alberta	Crown	15.1	–	7.4
	Private	–	–	2.0
	Total	15.1	7.6	9.4
Saskatchewan	Crown	3.6[b]	–	–
	Private	–	–	–
	Total	3.6	2.5	3.1
Manitoba	Crown	2.6	1.3	1.6
	Private	0.0	0.0	0.0
	Total	2.6	1.3	1.6
Ontario	Crown	28.4[b]	15.0	15.8
	Private	–	5.4	7.7
	Total	28.4	20.4	23.5
Quebec	Crown	31.0	–	–
	Private	4.7	–	–
	Total	35.7	30.3	33.1
New Brunswick	Crown	4.4	–	–
	Private	3.7	–	–
	Total	8.1	6.6	7.6
Nova Scotia	Crown	0.9	–	–
	Private	2.6	–	–
	Total	3.5	3.0	3.3
P.E.I.	Crown	0.1	–	–
	Private	0.2	–	–
	Total	0.3	0.2	0.2
Newfoundland[c]	Crown	3.0	–	–
	Private	–	–	–
	Total	3.0	2.5	2.4
Canada	Crown	163.8	–	–
	Private	11.2	–	–
	TOTAL	175.0	145.7	161.9[d]

Dash indicates not available.

[a]Includes hardwoods. "Crown" includes some private lands in TFLs. "Private" includes some unregulated Crown.
[b]Maximum allowable depletion from all sources.
[c]Includes Labrador. "Crown" includes some private.
[d]Approximately 19.2 million m^3 of this harvest is from private and unregulated lands in British Columbia, Alberta, and Ontario for which no AAC has been calculated.

Sources: Forestry Canada and provincial annual reports.

Source: K.L. Runyon, *Canada's Timber Supply: Current Status and Outlook*, Information Report E-X-45, Forestry Canada, Ottawa, 1991, p. 24.

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softwood harvest by the year 2050,(50) a projection disputed by environmentalists. No one is arguing, however, that hardwoods remain clearly under-utilized, with a global harvest level of slightly more than one-quarter of the AAC.

Some of the concerns of environmentalists are justified, considering the present state of Canada's forests. Despite major efforts in the field of forest regeneration and silviculture during the 1980s, the fact remains that approximately 200,000 hectares of the one million hectares harvested annually are not adequately regenerated. As a result, between 1976 and 1986, the total area of productive forestland in Canada declined by 4.7 million hectares.(51) Forestry Canada estimates that every year fires, pests and disease ravage a volume of wood almost equivalent to the amount harvested.(52) The total area of not satisfactory restocked forestlands in Canada remains difficult to determine precisely. At the beginning of the 1980s, the Science Council of Canada provided an estimate of 25 million hectares,(53) a figure recently quoted by the Canadian Institute of Forestry in its brief on global warming to the House of Commons Environment Committee.(54) Today, Forestry Canada estimates that the area of land inadequately regenerated is probably less than 5 million hectares.(55)

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(50) F.L.C. Reed, *Canada's Timber Situation in 2050,* Prepared for "Canada's Timber Resources: A National Conference," Victoria, B.C., 3-6 June 1990; published in the Minutes of Proceedings of the meetings of Task Force S408, P4.11 and S4.07-06 held as part of the 19th IUFRO Congress, Montreal, Quebec, Canada, 9 August 1990, p. 106-123.

(51) Forestry Canada (1991), p. 25 and 59.

(52) *Ibid.*, p. 26 and 58.

(53) Science Council of Canada (1983), p. 5-9.

(54) Canadian Institute of Forestry, "Global Warming: CIF Brief to Standing Committee on Environment, House of Commons," Ottawa, 15 December 1989; *Forestry Chronicle,* 66(2), April 1990, p. 180-181.

(55) Forestry Canada, personal communication, 28 January 1991.

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HARVESTING, MANAGEMENT AND REFORESTATION

In the natural forest, there is a certain balance between losses (from fires, insects and other causes) and gains (from the growth of trees). When forests are intensively used, an attempt is made to improve the forest's capital by reducing natural losses and improving stand productivity. Thus, basic forest management normally includes protective measures in combination with artificial regeneration of the land. Management of forestland is a very complex subject. Until the end of the 1970s, forestry emphasized the actual harvesting process. Very little in the way of human or material resources was directed to increasing or even simply maintaining productivity.(56)

Nevertheless, inadequate regeneration of forestland is a serious and fundamental problem in Canada. The new forests developing in areas harvested or affected by natural disasters are frequently poorer than the forests they replace. They are often inadequate in terms of preferred species, quality, density of stocking, insect and disease resistance or location suitable for economic supplies of wood to existing mills. The problem of forest renewal is not, as sometimes believed, simply a question of replanting and afforestation.

> Solutions ... are much more complex involving all aspects of silviculture. This includes treatments such as ground preparation to promote natural seeding of the most desirable species, and thinnings and clearings when regeneration is well established or when undesirable species threaten to suppress the species favoured for forest management purposes. The introduction of fast-growing hybrids also has great potential in improving forest productivity.(57)

Thus, it is possible to improve production and shorten the length of time required to grow a forest. Experience in Canada and in

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(56) Paul-E. Vézina and Marcien R. Roberge, *Comment aménager nos forêts*, Les Presses de l'Université Laval, Québec City, 1981, p. 7.

(57) André Lafond, "The Forestry Schools and Their Contribution to Solving the Problems of Regenerating Canadian Forests," *Tomorrow's Forests ... Today's Challenge?*, Proceedings of the National Forest Regeneration Conference, Canadian Forestry Association, Quebec City, October 1977, p. 142.

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similar northern forests elsewhere has demonstrated that gains in volume of 50%, 100% or more can be achieved.(58) This is of great interest when we consider that the productivity of Canada's forests is 60% less than that of Sweden's, and also lags behind productivity in the United States and the Soviet Union.(59) In Norway, Sweden and Finland, countries with a long tradition of forest management, 110 million m^3 of wood are cut each year - about 70% of Canada's annual production. Remarkably, this volume can be cut in an area of 50 million hectares or about one-quarter of Canada's productive forestland.(60)

Intensive management not only means that higher-quality timber can be produced in a shorter time. It also means lower logging and handling costs as intensive treatments are applied near manufacturing plants.(61) Like agriculture, management must be carried out in certain well-defined areas. The ideal long-term forest management plan consists of increasing the productivity of all forestland; realistically, however, accessibility determines management. According to Marcel Lortie, forestry engineer at Laval University, the wood and mills must be brought closer to the people by making forests grow in populated areas.(62) Thus, forest management will be forced to change from "mining" to farming the forest resource.(63)

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(58) Environment Canada, *A Forest Sector Strategy for Canada*, Canadian Forestry Service, Ottawa, 1981, p. 14.

(59) François Berger, "Une pénurie de bois à prévoir d'ici quinze ans: l'industrie canadienne du bois devra investir $50 milliards pour préserver ses marchés," *La Presse*, 21 February 1984.

(60) Stig O.A. Hagner, "Forest Management Under New Conditions: What Has Been Done in Scandinavia?," *The Forest Imperative*, Proceedings of the Canadian Forest Congress, Toronto, September 1980, p. 43.

(61) Environment Canada, *A Forest Sector Strategy for Canada* (1981), p. 14.

(62) G. Beaulieu (1983), "Pour sortir la forêt de la crise," p. 14.

(63) Forestry Canada, *Forestry Canada - New Partners in an Era of Change*, Information Brochure, 8 p.

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A. Forest Ecology and Silviculture

Encouraging the development of the forest industry is one thing, but when this detrimentally affects the environment that nourishes the forest, it is time to ask questions about the relevance of the knowledge and management methods of the developers. Canada may well have entered a new era of forest management. Instead of considering the forest as an inexhaustible resource to be exploited, and believing that remote wood supplies can always be reached simply by building more roads, we must think of the forest environment as a number of interrelated ecosystems whose real value may be something more than its commercial worth alone.

In order to assess the nature and scale of the stress produced by forestry operations, we must first consider our land management objectives and understand the forest ecosystem dynamics, functioning and recovery processes.(64) Declines in soil fertility, reduction in the number of species, side effects on tree quality and on all flora and fauna, destruction of unique or precious habitats and deterioration of prized landscapes are all possible negative outcomes of lumbering operations.

A 1980 study maintained that there are more than 80 parameters that may affect any of the numerous activities involved in harvesting the forest biomass.(65) These variables involve climate, water, soil, vegetation and animal populations. The impact of harvesting on regeneration is obvious: the trees and shrubs are all eliminated, thereby also removing the source of seeds. Some factors related to the quality of seedbeds may also hamper regeneration; they include the decrease in nutritive elements, moisture content and organic content of the topsoil, as well as the increased temperature of the soil. On the other hand, the last two factors might encourage regeneration, for instance, if they were approaching limiting levels before the cut took place. In fact, the overall effect of harvesting the forest is the sum of the various impacts on all the elements within the environment. Taking regeneration as an

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(64) Environment Canada, Lands Directorate, Wendy Simpson-Lewis *et al.*, Co-ordinator, *Stress on Land in Canada*, Ottawa, 1983, p. 267.

(65) In this study, the term "forest biomass" includes not only the marketable species of trees but all botanical elements in the biotope.

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example, three critical variables have a direct influence on regeneration and thus should be controlled. These are: exposure to the sun, erosion and the method of tree removal. A wide range of mitigating activities can minimize the negative impacts of wood harvesting. Preparation of a comprehensive intervention strategy will make it possible to assess some of these and guarantee optimum use of the forest without serious environmental damage.(66) According to ecologist Michel Jurdant, "the assassination of our forests" (measured in terms of annual lack of growth) results more from the absence of positive human intervention than from the presence of harmful activities, even though the latter are often more spectacular.(67)

Silviculture provides various solutions to problems associated with specific sites, relying heavily on species restocking methods and on the forest's evolution and conditions.(68) Silviculture consists of a variety of treatments that make it possible to exercise some control over the structure and composition of the forest. Regenerative cutting, scarifying (mechanical preparation of the soil), controlled burning, seeding, planting, clear-cutting, pre-commercial and commercial clearing, drainage and fertilization are examples of some silvicultural treatments.(69) Supported by fire protection and controls on disease and insects, silviculture makes it possible to increase forest productivity and thus decrease the threatened shortages of wood supplies. In short, there are a number of technical solutions available to solve the forest renewal problem. Nevertheless, improvements in forest management are restricted by

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(66) Environment Canada, Le Groupe Dryade, Canadian Forestry Service, *Evaluation des impacts potentiels de la récolte de la biomasse forestière*, Ste-Foy, August 1980, 48 p.

(67) Michel Jurdant, "Trois cents millions de plants pour une forêt capitaliste," *Le Devoir*, 30 June 1984.

(68) Environment Canada, *Stress on Land in Canada* (1983), p. 284-285.

(69) Bureau d'audiences publiques sur l'environnement, *Rapport d'enquête et de l'audience publique sur le programme de pulvérisations aériennes contre la tordeuse de bourgeons de l'épinette*, Ste-Foy, 1983, p. 83.

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the lack of manpower and of funding.(70) Thus, some people say that the cost of regeneration should be considered as a cost of harvesting, that is, a normal production cost. They also maintain that the costs of regeneration should be borne by all the beneficiaries in proportion to the benefits received.(71)

B. Human and Financial Resources and Forest Policy

Any organization trying to enforce a forest management policy is faced with three areas of concern: obtaining sufficient data on resources and technical operations, having a labour force well-trained in an appropriate working environment and establishing an enlightened contractual arrangement between government and industry.(72) The essential prerequisite for more intensive forest management must be the rationalization of reliable forestry data on growth, supply and depletion so that they may be integrated into systems with easy data retrieval. This requires a plan for a reliable program of growth estimation for management planning at local, regional and national levels.

Recognizing the need for intensive management if it is to continue using its forests, Canada must be able to count on enough foresters,(73) scientific researchers, forestry technicians and silvicultural workers. A study conducted in 1982 on this subject concluded that Canada should train some 4,500 new foresters between 1982 and 1992. Assuming that there are three forestry technicians for every forester under normal working conditions, it was calculated that by 1992 some 13,500

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(70) Environment Canada, *Stress on Land in Canada* (1983), p. 296.

(71) J.-P. Nadeau and R. Couturier (1977), p. 25.

(72) G.F. Weetman, "Forest Regeneration in Canada," *Tomorrow's Forests ... Today's Challenge?*, Proceedings of the National Forest Regeneration Conference, Quebec City, October 1977, p. 132.

(73) "Forester": this term includes university graduates in forestry, forest engineering and forest science, known as graduate foresters, logging engineers and "professional foresters."

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forestry technicians would be needed.(74) These forecasts were based on the hypothesis that Canada will move from harvesting to intensive management as standard forestry practice. In Sweden, for example, one forester may be responsible for approximately 10,000 hectares of forest, while relying on the assistance of two other professionals and at times, up to 10 technicians. In New Brunswick, the same forester will be responsible for 180,000 hectares of forest.(75) In order to manage all productive forestlands - 244 million hectares - under equivalent conditions, nearly 25,000 professional foresters would be required nationwide. At present, Canada has about 6,600 forestry experts.(76)

Control over logging methods in Canada is essentially a provincial responsibility, and the provinces also own 80% of commercial forestland. There is no federal legislation covering logging on private land. The smallest woodlots (1,000 hectares or less) are not subject to regulation and there are few fiscal incentives to encourage ecologically sound logging methods. Some of the most destructive harvesting methods are used in the forests with the easiest access, those closest to urban centres. At the provincial level, the use of forestland is governed by various Acts and administered by various departments. Most forested areas are used by large logging companies holding long-term permits and leases. The task of forest management is being handed over more and more to these companies.(77)

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(74) Marcel Lortie, *Evaluation of Future Canadian Requirements for Professional Foresters, Scientists With Basic Training in Forestry, and Forestry Technicians*, Report submitted to the Canadian Forest Advisory Council, 1982, 31 p.

(75) House of Commons, Standing Committee on Forestry and Fisheries, Sub-committee on Forestry (Bud Bird, Chairman), *Canada's Forests: The Federal Role*, Ottawa, November 1990, 187 p., p. 118.

(76) Omnifacts Research Ltd., *Survey of Professional Foresters in Canada*, Final report to Forestry Canada, Dartmouth, N.S., 1991, 37 p. and one appendix, p. 2.

(77) Questions related to forest tenures and forest management responsibilities in Canada are discussed in the document: David Haley and Martin K. Luckert, *Forest Tenures in Canada: A Framework for Policy Analysis*, Information Report E-X-43, Prepared for Forestry Canada, Economics Branch, Ottawa, 1990, 104 p.

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At each stage in the progress towards provincial forestry goals, the federal government's policies and programs come into play. The provinces and the industry have, however, long been worried about the lack of co-ordination of federal policies and programs related to the forest sector. Thus, since the end of the 1970s, the federal government has been trying to encourage long-term investments by the industry to improve forest management and maintain a modern, competitive industry.(78) After spending some time on modernizing mills, the governments have finally turned their attention to the important question of providing these mills with medium- and long-term supplies of raw materials.

In an effort to promote and intensify Canadian forestry management, the federal government in 1981 formulated a Forestry Strategy to provide the knowledge and resources needed for forest renewal.(79) The key component of the strategy was the establishment of Forest Resource Development Agreements (FRDA). The initial objectives of these agreements were to increase the area of reforested lands from 200,000 to 500,000 hectares per year and to carry out silviculture activities such as weeding, spacing and fertilization over an area of 400,000 hectares rather than 100,000 hectares. Moreover, these cost-shared agreements between the two highest levels of government also included a provision for forest research activities.

The first generation of agreements spanned the period from 1982 to 1989, during which time governments spent $1.1 billion (53.4% of this total was spent by the federal government, while 46.6% was spent by the provinces).(80) Figure 6 illustrates the breakdown of expenditures by sector of activity for all first-generation agreements. As can be seen,

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(78) Environment Canada, Canadian Forestry Service, *Federal Policy on the Canadian Forestry Sector*, Ottawa, December 1979, p. 14-21.

(79) Environment Canada (1981).

(80) The nature of the first and second generations of federal-provincial agreements, along with the related sums allocated, are reported as an appendix in three tables drawn up by Forestry Canada.

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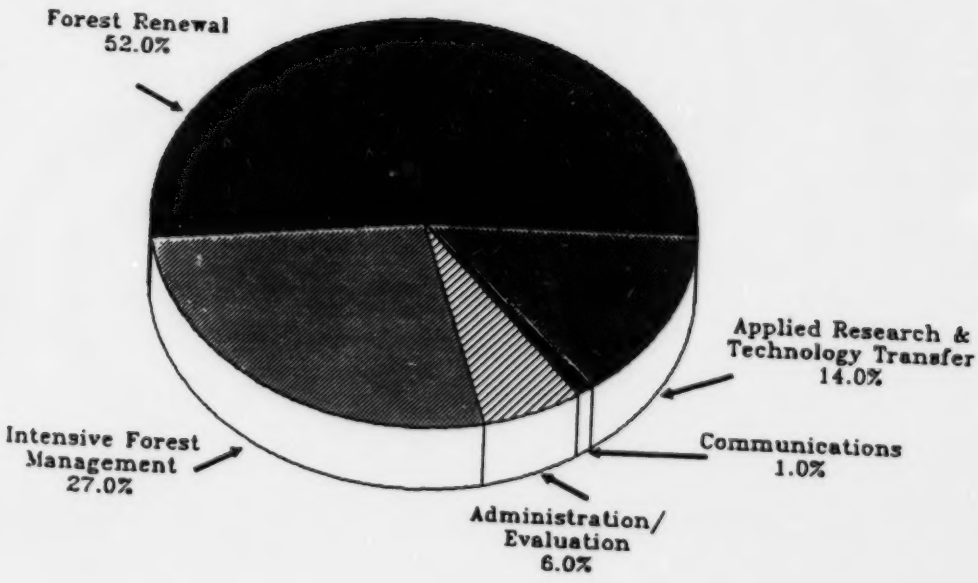
Figure 6

Distribution of Expenditures Under FRDA
(1982-89)



Source: Forestry Canada, *1991-1992 Estimates, Part III Expenditure Plan*, Ottawa, p. 52.

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79% of the amounts provided for under the agreements was allocated to regeneration and intensive forest management activities, whereas 14% was allocated to research and technology transfer. Specifically, these agreements resulted in the planting of 1.6 billion trees on more than 800,000 hectares of forestland, the site preparation of 820,000 hectares to be regenerated, and the treatment of another 800,000 hectares already undergoing regeneration.(81) By comparison, silviculture expenditures increased from $118 million in 1977 to $705 million in 1988. Including the amounts spent on forest protection, timber access and related activities, governments and industry spent a total of $2 billion in 1988 (see Table 10), as compared with $659 million in 1977.(82)

The federal government is now committed to the second generation of forestry resource development agreements. With a view to redirecting federal assistance in keeping with new priorities, the federal Forestry Minister, working with his provincial counterparts on the Canadian Council of Forestry Ministers, has proposed a series of principles, the main objective of which is to contribute actively to ensuring the sustainable development of the forest resource. Eight principles must guide the negotiation of all new federal-provincial agreements:

1) long-term forest management planning;
2) improved forestry data;
3) future generation of harvests by provinces and industry;
4) integrated resource management;
5) human resource development;
6) public awareness;
7) co-funding arrangements; and
8) technology transfer.(83)

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(81) Forestry Canada, *1991-1992 Estimates - Part III: Expenditure Plan*, Ottawa, p. 53.

(82) Forestry Canada (1991), p. 65 and 76.

(83) Forestry Canada, *1991-1992 Estimates - Part III: Expenditure Plan*, Ottawa, p. 49.

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Table 10

Forest Management Expenditures in Canada

	1985	1988	% CHANGE PER YEAR[1] 1985-1988	% CHANGE PER YEAR[1] 1979-1988
FOREST MANAGEMENT EXPENDITURES ($000 000)				
Silviculture				
Provincial	349.8	452.1	+ 8.9	+16.4
Federal	63.5	105.6	+18.5	+16.4
Industry[2]	63.3	147.3	+32.5	+23.6
Total	**476.6**	**705.0**	**+13.9**	**+17.6**
Forest Protection				
Provincial	299.3	355.6	+ 5.9	+12.2
Federal[3]	20.4	1.9	-24.0	- 6.9
Industry[2]	39.4	39.4	0.0	+ 7.3
Total	**359.1**	**396.9**	**+ 3.4**	**+10.8**
Resource Access[4]				
Provincial	99.8	101.5	+ 1.7	+ 3.8
Federal	8.1	3.5	-16.2	- 6.9
Industry[2]	238.8	179.5	- 7.7	- 0.8
Total	**346.7**	**284.5**	**- 5.7**	**0.0**
Other Activities[5]				
Provincial	314.1	378.6	+ 6.4	+ 8.8
Federal	117.0	114.8	- 0.6	+10.7
Industry[2]	64.4	136.3	+28.4	+14.0
Total	**495.5**	**629.7**	**+ 8.3**	**+10.1**
TOTAL FOREST MANAGEMENT EXPENDITURES				
Provincial	1063.0	1287.8	+ 6.6	+11.3
Federal	209.0	225.8	+ 2.6	+ 9.1
Industry[2]	405.9	502.5	+ 7.4	+ 6.8
Total	**1677.9**	**2016.1**	**+ 6.3**	**+ 9.8**

[1] Annual compounded rate of growth over the period.
[2] 1988 industry figures are estimates.
[3] The drop since 1985 occurred as a result of the transfer of responsibilities for forest management activities from the federal government to the Northwest Territories. The federal expenditures on Forest Insect and Disease Survey (FIDS) of $3.56 million are included in the forest research component of "Other Activities".
[4] Resource access includes expenditures for permanent roads, bridges and other supporting infrastructure.
[5] Other Activities include forest management research, inventory, timber management, administration and other.

Source: Forestry Canada, *The State of Forestry in Canada, 1990 Report to Parliament*, Ottawa, April 1991, p. 65.

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To date, most provinces have signed new forestry development agreements with the federal government. However, total commitments by the two levels of government are lower than was the case for the first-generation agreements. As of the summer of 1991, commitments under the agreements totalled $580 million (see second table in Appendix). An agreement in principle was reached between Quebec and the federal government in September 1991 for a total commitment of $200 million. The governments of Ontario and Canada signed an agreement in November 1991 committing $50 million to forestry development in northern Ontario.

In 1987, a new *National Forest Sector Strategy for Canada* (84) was published under the aegis of the Canadian Council of Forest Ministers. For the first time, the strategy reflects the views of many forest sector agencies and individuals who had been consulted. The 1987 strategy set out 34 recommendations and addressed five major concerns: trade and investment in the forest sector; forestry management; employment; research, development and innovation; and public awareness. Among other things, it was recommended that a federal department be established to oversee forests and the forestry industry and thus ensure the vital coordination of Canada's forest sector.

In September 1988, it was announced that a federal department devoted exclusively to forests would be created and proposed legislation to this effect was tabled in the House of Commons in June 1989. The *Department of Forestry Act,* which was adopted on 1 November 1989 and which came into force on 23 February 1990, is the first federal statute to introduce and define the concept of sustainable development, a concept that will henceforth guide the plans and activities of Forestry Canada. From this moment on, forestry resources must be developed with an eye to sustainable development, always bearing in mind the competitiveness of Canada's forest sector on the international market. To Forestry Canada, "sustainable development of the forests and their multiple environmental values involves fostering, without unacceptable impairment, the

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(84) Canadian Council of Forest Ministers, *National Forest Sector Strategy for Canada,* Supply and Services Canada, Ottawa, 1987, 25 p.

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productivity, renewal capacity, and species diversity of forest ecosystems." It is, therefore, a matter of keeping the impact of human activities below the tolerance level of forest ecosystems. The new department plans to focus on four strategic areas: national leadership, forest sector development, forest environmental quality, and science and technology.(85)

To establish the basis for sustainable forest development and also, no doubt, to keep the role of the new federal Department of Forestry current, the Canadian Council of Forest Ministers undertook broad-based consultations with the major sector players. As in 1987, this process will culminate in a new national strategy for the forestry sector, which will be unveiled and approved at a national forestry congress slated to be held in Ottawa in March 1992.

C. Research

> The first duty of forestry research is to achieve a complete understanding of the world's forest ecosystems, to increase their productivity in terms of both quality and quantity and to improve the rate of conversion and utilization of forest products.(86)

So said an important declaration made at Kyoto in 1981, at the 17th World Congress of the International Union of Forest Research Organizations (IUFRO). The future of our forest industries and forest resources increasingly depend on this type of research.

Forestry research involves a multitude of investigative areas grouped into different fields of research:(87)

- The forest environment - environmental and political forestry factors; atmospheric pollution; forest and plant ecology.

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(85) Forestry Canada, *Forestry Canada: Preparing for the Future - Our Strategic Plan*, Ottawa, 1990c, 10 p.

(86) J. Pardé, "Le congrès de IUFRO à Kyoto," *Revue forestière française*, Special Issue, 1983, p. 17.

(87) I.C.M. Place, *Forest Research in Canada 1979-80 and 1985-86*, Forestry Research Advisory Council of Canada, Forestry Canada, Ottawa, 1988, 93 p., p. 2 and 78.

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- Forest production - trees and seeding improvement; reforestation; growth of trees and forest stands; management systems.

- Forest protection - fires and pests; chemical pesticides; biological and integrated control systems.

- Non-destructive forest use - wildlife and recreation; urban forestry.

- Forestry development - forest biomass; wood products; pulp and paper; forest engineering.

- Forestry services - report on pests and disease; forestry resource data; technology transfer.

- The economy and forestry policies.

- Major capital projects.

Today, Forestry Canada continues to view research as one of five priorities or strategic orientations of the federal government's involvement in the forest sector. Taking into account Canada's competitors and the importance of the country's forest sector, it is clear that research and development (R&D) programs are inadequate.(88) In fact, it is estimated that Canada's overall research budget for 1985-86 represented only 0.9% of the total value of forest product shipments. During the same period, however, the sums committed to research by industry, private research institutes and industrial associations accounted for only 0.3% of the value of shipments.(89) The United States and Scandinavian countries, Canada's traditional competitors in the forest sector, spend in proportion 2.5 times more resources on R&D.(90)

Of course, the most recent data on the status of research show some degree of improvement, at least in absolute figures. Commitments to forestry R&D in 1988 totalled $351 million (see Table 11), compared to $290 million in 1985-86. However, the sums invested in R&D in 1988

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(88) Forestry Canada, *Forestry Canada: Preparing for the Future - Our Strategic Plan*, Ottawa, 1990c, p. 9.

(89) I.C.M. Place (1988), p. vii.

(90) Forestry Canada (1990c), p. 4.

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Table 11

Research and Development Expenditures Account

Sources of funds	1988 ($000 000)	Performers[4]	1988 ($000 000)
Federal Government	105.7*[1]	Federal Government	59.4
Provincial Governments	43.8	Provincial Governments	30.2
Universities	7.0[1]	Universities	29.0[1]
Industry[2]	166.0[1]	Industry[2]	187.7[1]
Others[3]	28.1[1]	Industrial Research Institutes[5]	44.3
Total	**350.6[1]**	**Total**	**350.6[1]**

TOTAL CONTRIBUTION TO RESEARCH AND DEVELOPMENT IN FORESTRY 1988

SOURCES OF FUNDS / PERFORMERS	FEDERAL GOVERNMENT	PROVINCIAL GOVERNMENTS	UNIVERSITIES	INDUSTRY[2]	INDUSTRIAL RESEARCH INSTITUTES[5]	TOTAL CONTRIBUTION BY REPORTING AGENCIES
Federal Government	59.4	1.0	14.3[1]	21.3	9.7	**105.7*[1]**
Provincial Governments	–	29.2	5.5[1]	5.6[1]	3.5	**43.8**
Universities	–	–	7.0[1]	–	–	**7.0[1]**
Industry[2]	–	–	1.0[1]	136.3[1]	28.7	**166.0[1]**
Others[3]	–	–	1.2[1]	24.5[1]	2.4	**28.1[1]**
Total Intramural Research and Development	**59.4**	**30.2**	**29.0[1]**	**187.7[1]**	**44.3**	**350.6[1]**

1 Estimated.
2 Includes Research and Development expenditures by manufacturers of forestry equipment and forest fire fighting aircraft.
3 May include other Canadian and foreign sources, contracts and others.
4 Intramural expenditures: expenditures for Research and Development work performed within the reporting agency, including work financed by others.
5 Includes FERIC, FORINTEK and PAPRICAN.
– Nil.
* The total federal government contribution ($105.7 million) may be underestimated. The current reporting methodology does not allow us to clearly indicate the distribution of the federal portion of Research and Development funding ($9.6 million) under Forest Resource Development Agreements. Part of these funds may already be included under some of the performers.

Source: Forestry Canada, *The State of Forestry in Canada, 1990 Report to Parliament*, Ottawa, April 1991, p. 64.

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accounted for merely 0.7% of the value of shipments, while in Sweden, for example, this figure was 1.75% in 1985.(91) Thus, there is an urgent need for a significant increase in R&D activities in the forest sector. Canada's competitiveness is unquestionably at stake, as is its continued share of traditional markets in this area at a time when globalization of markets and the number of new suppliers on the market is increasing.

Understanding the functioning of forest ecosystems is fundamental to the success of any management program. Through understanding of the environment, biotechnology(92,93) and other powerful techniques will become our best instruments. In fact, forest resources and the forest industry can benefit greatly from the leading edge of biotechnology for species improvement, disease and insect control, efficiency improvements for pulp-making techniques, production of useful chemicals (such as butanol and ethanol, for example), treatment of pulp and paper mill wastes or production of unicellular proteins.(94,95)

Aside from biotechnologies, much remains to be accomplished in the field of R&D, even in the more traditional areas of forestry, such as timber harvesting techniques, forest regeneration and general silviculture practices, not to mention the fight against fires and pests. Canada needs to increase its level of R&D funding if it wants to remain a leader in the field of natural resources. Specifically, it is crucial that Canada

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(91) Canadian Council of Forest Ministers, *Report of the Implementation Committee - Innovation and Technology: Science in the Forest Sector*, Ottawa, September 1988, p. 2.

(92) Biotechnology: a generic term which includes a range of techniques (cell culture, enzyme engineering, genetic engineering, cell fusion) which may be used in the treatment of materials by biological agents (micro-organisms) to produce goods and services.

(93) For more background on this subject, see J.-P. Amyot, *Biotechnology: A Revolution Full of Promise*, Background Paper BP-64E, Research Branch, Library of Parliament, Ottawa, February 1983, 62 p.

(94) G. Beaulieu, "Biotechnologie: Mettre la forêt dans le coup," *Forêt Conservation*, Vol. 51, No. 2, May 1984, p. 16-18.

(95) G. Beaulieu, "Biotechnologie: Pour mieux transformer le bois," *Forêt Conservation*, Vol. 51, No. 3, June 1984, p. 16-18.

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adopt an innovative approach with a view to increasing the value added, not just with respect to wood products, but in the paper sector as well. This is one area in which Canada must seek to diversify more, given international competition in the pulp and newsprint sectors. Lastly, current public concerns over the quality of the environment also call for a sustained research effort with respect to the environmental repercussions of Canada's forestry sector activity. Similarly, global environmental problems, such as climate changes and transborder pollution, including acid rain, call for a similar effort.

CONCLUSION

Canada's forests are complex, dynamic biological systems which, since their creation, have been subject to radical disturbances. A great deal of our forest heritage has already been considerably altered by human activities such as burning, excessive cutting and harvesting with no regeneration. Thus, when the forests are considered only in terms of their marketable value, more often than not they suffer ecological deterioration.

Harvesting the forest using concepts and operating methods that practically ignore reforestation and management can lead only to an impasse. Perceptive use of forest resources does not mean maintaining them as they were before any development; however, we must be able to determine the impact of our actions and ensure that our use of the environment does not leave it barren. The forester's main duty is to make the forest a better producer of the goods and services it provides naturally. Thus, research, management and silviculture are vital to Canadian forest management in the context of sustainable development. What we now think of as long-term investments will be seen tomorrow as inevitable maintenance costs for sustaining our competitive position.

The current state of our forest resources and the growing demand for forest products justify placing the highest priority on developing a philosophical framework for the rational, integrated use of our country's forestlands. Reforms in forest operations, improvements to private woodlots, an intensive management program, use of surplus biomass,

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salvage of forest products - these current ideas are already shaping tomorrow's forests. The forest reminds us sternly that we shall reap as we sow.

Canada is firmly committed to a transitional period of forestry resource management and development. The rate of this transition from an approach essentially involving "mining" timber to one that places greater emphasis on regeneration must be accelerated, always bearing in mind the need to uphold the principles of integrated management of all of Canada's forest resources. Providing for the sustainable development of our forests will require special cooperation from all forest sector players, ranging from industry to the general public. The ultimate objective will be to adopt an overall common vision of forest management so that the resource can continue to meet the demands of industry while its other uses can be promoted, from a social as well as an environmental perspective.

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APPENDIX

Federal - Provincial Forestry Initiatives
First Generation Funding
($ 000)

Agreements	Federal	Provincial	Total
Canada - Newfoundland Forest Resource Development Agreement (1986 - 1990)	35,840 70.0%	15,360 30.0%	51,200
Canada - Prince Edward Island Forest Resource Development Agreement (1983 -1988)	13,688 68.0%	6,456 32.0%	20,144
Canada - Nova Scotia Forest Resource Development Agreement (1982 -1989)	50,363 53.9%	43,063 46.1%	93,426
Canada - Nova Scotia Forest Renewal Agreement (1984 - 1987)	17,000 66.7%	8,500 33.3%	25,500
Canada - New Brunswick Forest Renewal Subsidiary Agreement (1984 -1989)	42,340 54.7%	35,060 45.3%	77,400
Canada - Québec Forest Development Subsidiary Agreement (1985 -1990)	150,000 50.0%	150,000 50.0%	300,000
Eastern Québec Forest Development Program Phase I (1983 -1988)	25,700 100.0%	- 0.0%	25,700
Special Canada - Québec Subsidiary Agreement for the Forest Development of the Upper North Shore (1987 -1992)	6,500 50.0%	6,500 50.0%	13,000
Canada - Ontario Forest Resource Development Agreement (1984 -1989)	75,000 50.0%	75,000 50.0%	150,000
Canada - Manitoba Forest Renewal Agreement (1984 -1989)	13,580 50.0%	13,580 50.0%	27,160
Canada - Saskatchewan Forest Resource Development Agreement (1984 -1989)	14,000 50.0%	14,000 50.0%	28,000
Canada - Alberta Forest Resource Development Agreement (1984 -1989)	11,500 50.0%	11,500 50.0%	23,000
Canada - British Columbia Forest Resource Development Agreement (1985 -1990)	150,000 50.0%	150,000 50.0%	300,000
Total:	605,511 53.4%	529,019 46.6%	1,134,530

Federal - Provincial Forestry Initiatives
Second Generation Funding
($'000)

Agreements	Federal	Provincial	Total
Canada - Nfld./Lab Forestry Training Assoc. Forestry Youth Training Cooperation Agreement (1990 -1993)	9,000 80.0%	2,250 * 20.0%	11,250
Canada - Newfoundland Cooperation Agreement for Forestry Development (1990 -1995)	45,000 70.0%	19,300 30.0%	64,300
Canada - Prince Edward Island Forest Resource Development Agreement (1988 -1993)	14,200 59.0%	9,883 41.0%	24,083
Canada - Nova Scotia Cooperation Agreement for Forestry Development (1989 -1991)	24,750 55.0%	20,250 45.0%	45,000
Canada - New Brunswick Cooperation Agreement on Forestry Development (1989 -1994)	50,000 54.9%	41,000 45.1%	91,000
Eastern Quebec Forestry Development Program - Phase II (1988 -1993)	49,900 100.0%	- 0.0%	49,900
Québec Maple Dieback (1988 - 1993)	5,050 50.0%	5,050 50.0%	10,100
Canada - Manitoba Partnership Agreement in Forestry (1990 -1995)	15,000 50.0%	15,000 50.0%	30,000
Canada - Saskatchewan Partnership Agreement in Forestry (1990 -1995)	15,000 50.0%	15,000 50.0%	30,000
Canada - British Columbia Partnership Agreement on Forest Resource Development: FRDA II (1991 -1995)	100,000 50.0%	100,000 50.0%	200,000
South Moresby Replacement Account (1988 -1996)	12,000 50.0%	12,000 50.0%	24,000
Total:	339,900 58.6%	239,733 41.4%	579,633

* This funding is provided by the Newfoundland and Labrador Forestry Training Association.

Assistance for Woodlots
Federal Agreements
(1982 - 1995)

	Total Agreement (SM)	Total Woodlot Programs (SM)	Federal: Provincial Contribution (% for Total Agreement)	Allocated to Date: Federal Woodlot Contribution (SM)	Allocated to Date: Provincial Woodlot Contribution (SM)
Newfoundland					
Forestry Subsidary Agreement : 1981-1986	63.4	0.0	90:10	0.00	0.00
FRDA : 1986-1990	48.0	1.5	70:30	1.05	0.45
CAFD : 1990-1995	64.3	2.75	70:30	2.10	0.65
Nova Scotia					
FRDA : 1982-1989	91.4	55.1	55:45	46.90	8.20
FRA : 1984-1987	25.5	11.2	67:33	9.30	1.20
CAFD : 1989-1991	45.0	25.5	55:45	17.10	8.40
Prince Edward Island					
FRDA : 1983-1988	20.1	10.8	68:32	8.50	2.30
FRDA(II) : 1988-1993	24.0	9.7 *	59:41	7.60 *	2.10 *
New Brunswick					
GDA Subsidary Agreement : 1980-1984	37.5	2.5 *	80:20	2.00 *	0.50 *
FRA : 1984-1989	77.4	15.2	55:45	12.90	2.30
Cooperation : 1989-1994	91.0	27.0 *	55:45	21.88 *	5.13 *
Québec					
FRDA : 1985-1980	300.0	90.0	50:50	45.00	45.00
Gaspé Plan I : 1983-1988	27.5	27.5	100F	27.50	0.00
Gaspé Plan II : 1988-1993	50.0	20.6 *	100F	20.60 *	0.00 *
Maple Dieback : 1988-1993	10.1	6.6 *	50:50	1.75 *	1.75 *
Ontario					
COFRDA : 1984-1989	150.0	8.5	50:50	4.25	4.25
Manitoba					
FRDA : 1984-1989	27.2	0.0	50:50	0.00	0.00
Saskatchewan					
FRDA : 1984-1989	28.0	0.5	50:50	0.50	0.00
Alberta					
FRDA : 1984-1989	23.0	0.0	50:50	0.00	0.00
British Columbia					
FRDA : 1985-1990	300.0	4.8	50:50	4.80	0.00
Total:	1,503.4	319.8		233.73	82.23

Note: Figures noted with an "*" indicate contribution to 1990 from agreements not yet completed.

Bob Woods
Forestry Development
June 26, 1991

Forest Resource Development Agreement Funding to Activities on Aboriginal Lands ($)

from April of 1982 to March of 1990

based on the DEVIND database

Province	Planning/Inventory	Site Preparation	Regeneration	Tending	Access/Roads	Extention	Miscellaneous	Non-Forestry	Protection	Total	Expendit
Newfoundland										0	Federa
										0	Other
Prince Edward Island										0	Federa
										0	Other
Nova Scotia	48,069	3,697	3,498	39,817	132,982		2,220	4,592		234,875	Federa
										0	Other
New Brunswick	16,820			443	68,192	3,000				88,455	Federa
										0	Other
Quebec	214,318	652,135	603,281	660,578	246,419	582,935	6,045	747,524		3,713,235	Federa
	57,481	18,542	12,980	100,344	35,980	22,164				247,491	Other
Ontario	789,687	476,932	616,911	919,539	5,503	30,800		20,663		2,860,035	Federa
	107,235	45,134	67,637	138,241		7,700		305		366,252	Other
Manitoba			8,203							8,203	Federa
										0	Other
Saskatchewan	121,695	15,850	53,294	71,105		2,100		5,000		269,044	Federa
	41,500			5,920						47,420	Other
Alberta	100,051	51,663	24,690	320,470		20,500			34,678	552,052	Federa
	11,058	16,800	1,084	72,957					3,250	105,149	Other
British Columbia	2,286,052	474,419	457,706	1,757,388		260,405		424,414		5,660,384	Federa
	632,215	94,118	132,619	571,464		15,000		92,162		1,537,578	Other
Sub-Totals	3,576,692	1,674,696	1,767,583	3,769,340	453,096	899,740	8,265	1,202,193	34,678	13,386,283	Federa
	849,489	174,594	214,320	888,926	35,980	44,864	0	92,467	3,250	2,303,890	Other
Total	$4,426,181	$1,849,290	$1,981,903	$4,658,266	$489,076	$944,604	$8,265	$1,294,660	$37,928	$15,690,173	

Definitions

Planning/Inventory	- Preparation of a plan for the operation of a forest property which contains silviculture prescriptions to optimize the use of all forest resources.
Site Preparation	- Disturbance of an area's top soil and ground vegetation to create conditions suitable for regeneration.
Regeneration	- Tree crops established artificially by means of sowing or planting.
Tending (Stand)	- Generally, any operation carried out for the benefit of a forest crop or an individual thereof at any stage of its life; covers operations on the crop itself and on competing vegetation, but not harvest cutting or site preparation.
Access/Roads	- Any activity that is related to road construction, road improvement, or road maintenance.
Extentions	- Refers to applied research, technology transfer, forestry data base and opportunity identification.
Miscellaneous	- Refers to miscellaneous forestry activities; for example maple syrup production.
Non-Forestry	- Refers to other non-forestry realated activities; for example administration and evaluations.
Protection	- Refers to fire protection and other prevention related protection.